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THESIS

AN ASSESSMENT OF CRITICAL FACTORS AFFECTING THE SELECTION OF VARIOUS ACQUISITION ALTERNATIVES USED TO RESOLVE COMPONENT NONAVAILABILITY

by

Sean P. O'Day

December, 1992

Thesis Advisor: R. J. Adams

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The ability to maintain and sustain the Army during peacetime operations and wartime utilization requirements, depends greatly on the availability of repair and spare parts. The readiness of aging systems in the Army's inventory is threatened by the component nonavailability problems. This thesis focuses on situations in which contracting officers and item managers are faced with critical factors affecting their decisions as to which acquisition alternative they chose. This study identifies and defines the component nonavailability issues, discusses why they occur, reviews current spare parts acquisition techniques, presents advantages and disadvantages associated with each acquisition alternative, and discusses and analyzes the critical factors that affect the decision making process. The researcher also proposes the use of the Rapid Acquisition of Manufactured Parts (RAMP) program to address the problems of high costs, growing leadtimes, and diminishing sources for spare parts.

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An Assessment of Critical Factors Affecting the Selection of Various Acquisition Alternatives Used to Resolve Component Nonavailability

by

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Submitted in partial fulfillment
of the requirements for the degree of

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ABSTRACT

The ability to maintain and sustain the Army during peacetime operations and wartime utilization requirements, depends greatly on the availability of repair and spare parts. The readiness of aging systems in the Army's inventory is threatened by the component nonavailability problems. This thesis focuses on situations in which contracting officers and item managers are faced with critical factors affecting their decisions as to which acquisition alternative they chose. This study identifies and defines the component nonavailability issues, discusses why they occur, reviews current spare parts acquisition techniques, presents advantages and disadvantages associated with each acquisition alternative, and discusses and analyzes the critical factors that affect the decision making process. The researcher also proposes the use of the Rapid Acquisition of Manufactured Parts (RAMP) program to address the problems of high costs, growing leadtimes, and diminishing sources for spare parts.

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I. INTRODUCTION

A. BACKGROUND

As the U.S. military is cutback in both money and personnel, systems in the Army that were slated for deactivation and disposal may have to find new life to maintain a level of readiness demanded by the threat. Modernization of our equipment in the near term will have to be accomplished by upgrading our fielded systems to insert modern technology that will provide us with the capability necessary to maintain a decisive combat edge. With many of our aging systems, the insertion of new technology may not be possible due to the design of the equipment. The Army wants to focus on long-term solutions, such as leap-ahead technologies and shape them for appropriate applications. But since the world is still a far cry from a peaceful place, we must still focus on our capabilities for today. [Ref. 1:p. 46]

This study will focus on the problem of nonavailability and acquiring components for out-of-production and aging systems as it relates to low density items in the U.S. Army inventory. This research will examine the various critical factors and acquisition alternatives as they apply to resolving the problems associated with component nonavailability of aging systems. These low density items create problems for contracting officers and item managers since the items must still be supported to ensure their readiness and availability. It appears obvious that the capability to maintain and sustain military forces in peacetime deterrence and mobilization missions, relies heavily upon the continued availability of system components.

Major systems and their associated equipment are made up of thousands of parts and subassemblies. Spare parts are purchased to replace or repair those parts that wear out, malfunction or break, in order to keep a system in a full readiness posture. We must look to the future to ensure that we will have access to the quantity and quality of spares necessary to maintain that readiness posture.

B. THESIS OBJECTIVE

The objective of this thesis research is to provide contracting officers and item managers with an overview of supporting nonavailable aging items and components in the United States Army inventory and provide recommendations to better manage and streamline the acquisition process for components of these items. The study is organized to define the current problems, explain why they occur, describe current procedures, identify the advantages and disadvantages associated with each acquisition alternative, identify and analyze each critical factor, and provide recommendations to attempt to solve many of the problems and possibly reduce the length of the present acquisition process for these components.

C. RESEARCH QUESTIONS

The primary research question for this study is: What are the critical factors decision makers must consider that will assist in the identification and selection of the optimum acquisition alternative?

Secondary research questions include:

- What might be a typical scenario under which acquisition problems surface for components of aging equipment?
- What are the key reasons requirements for nonavailable components cannot readily be met?
- What alternatives are currently available and utilized to resolve the problems associated with nonavailable components?

D. SCOPE, LIMITATIONS AND ASSUMPTIONS

The scope of this thesis is concerned with the problems associated with the nonavailability of system components from contractors and subcontractors specifically supporting the troop side of the Aviation and Troop Command (ATCOM) and its subsequent effect on the maintainability and readiness of U.S. Army units. This thesis is primarily concerned with the acquisition of nonavailable spare parts for low density items in the U.S. Army inventory, although, it is relative to other high density systems that are out of production.

The selected components represent situations in which the criticality of the system is a major factor. That is, the item's readiness is seriously affected by the absence or failure of the component. This thesis is not intended to be a detailed study of the logistics and maintenance support operations within the U.S. Army systems commands.

It is assumed that the reader is familiar with basic procurement problems and basic Army terminology.

E. LITERATURE REVIEW AND METHODOLOGY

The information presented in this thesis was obtained through literature searches using: the Defense Logistics Studies Information Exchange (DLSIE), the Defense Technical Information Center (DTIC), current Federal and Department of Defense (DOD) regulations and directives, personal and telephone interviews with contracting officials and item managers, a questionnaire, previous theses, and a review of current publications and periodicals relevant to the subject.

The researcher selected critical components from systems managed by a subordinate command of the Army Materiel Command (AMC), the Aviation and Troop Command (ATCOM), St. Louis, Missouri. The researcher relied primarily upon the data provided by the contracting officials and item managers of each system through personal or telephone interviews. The personal interviews provided information on actual specific situations and problems involving nonavailable aging system components and discussed the alternatives available to them at the time of occurrence. The researcher reviewed the procedures available to resolve the problem, as well as the actions taken to resolve the situation. In most cases the resolution appeared to deviate from established acquisition procedures.

F. DEFINITIONS AND ABBREVIATIONS

Specific terminology used in this thesis will be defined in the text of the thesis with the applicable terminology if the researcher feels it is pertinent to the flow of the material presented. All other definitions to peculiar terminology are presented in Appendix A.

All abbreviations and acronyms are preceded by their full name the first time they are presented in the text of the thesis. Appendix B will also list each acronym utilized in the thesis.

G. ORGANIZATION OF THE THESIS

This thesis is organized into six chapters. Chapter I provided the background, objectives, research questions, scope, limitations, assumptions, methodologies, definitions, and organization of this thesis. Chapter II is the background chapter intended to provide general information on the classes of spare parts, the Department of Defense and the Army spare parts acquisition processes.

Chapter III presents the theoretical and analytical framework found in the literature concerning the spare parts acquisition problems, and a description of the Navy's Rapid Acquisition of Manufactured Parts (RAMP) program. Chapter IV presents the perceived factors causing the acquisition problems, the specific items evaluated, acquisition alternatives, and the data collected by use of a survey questionnaire.

Chapter V presents the advantages and disadvantages associated with each possible acquisition alternative and an analysis of the data. Chapter VI summarizes the research and provides recommendations based upon the analysis in Chapter V. The specific research questions addressed in this thesis are answered in this chapter.

II. BACKGROUND

A. INTRODUCTION

Spare parts acquisition has received a significant amount of attention in recent years due to several defective pricing incidents. It is important to understand all of the factors that influence the spare parts acquisition process, such as, risk assessment, Government regulations, financial considerations, availability of technical data packages (TDP), and others. Much of the attention given to the problem of component nonavailability appearing in recent literature seems to have centered around electronic components. Several studies and articles have been written on electronic component obsolescence and nonavailability, but few have addressed the hardware component nonavailability issue.

This chapter reviews what comprises a spare part, the classes of spare parts, the overall DOD view on the spare parts replenishment process, and current Army spare parts acquisition processes and procedures.

B. CLASSES OF SPARE PARTS

According to the Defense Federal Acquisition Regulation Supplement (DFARS), the description of spare parts is as follows:

Spare Parts. Spares and repair parts, reparable and consumable, purchased for use in the maintenance, overhaul, and repair of equipment such as ships, tanks, guns, aircraft, missiles, ground communication and electronic systems, ground support and associated test equipment. It includes items, spares, repair parts, parts, subassemblies, components, and subsystems, but excludes end items such as aircraft, ships, tanks, guns, and missiles. [Ref. 2:p. 5]

There are two classes of spare parts: consumables and reparables.

1. Consumable Spare Parts

Consumables are spare parts that are disposed of when they fail or are used up. The DOD generally refers to these now as "repair parts". [Ref. 3:p. 15-15] Consumables are generally less expensive than reparables. They include items such as resistors, transistors, bearings, diodes, nuts, bolts, and screws. Consumables comprise 75-80 percent of the spare parts inventory, yet they represent only 20-25 percent of DOD's monetary investment in spare parts. [Ref. 4:p. 28]

2. Reparable Spare Parts

Reparables on the other hand are spare parts that are repaired when they fail, or on a pre-arranged rework cycle, and then are returned into the inventory. The DOD generally refers to these now as just "spare parts". [Ref. 3:p. 15-16] Reparables include such items as pump shafts, hydraulic pumps, valve assemblies, avionics, etc. These parts are repaired by maintenance personnel at either the organizational, intermediate, or depot level using consumable spare parts. [Ref. 4:p. 29]

Throughout this thesis the terms spare part or component will be referring to both consumable and reparable spare parts and components.

C. REPLENISHMENT OF SPARE PARTS

Subsequent procurement of spare parts, after the system is fielded, is accomplished by means of the replenishment process. This process is based on a new demand history for the provisioned spare parts. [Ref. 2:p. 159] An Inventory Control Point and a specific manager are designated for each item and spare part.

To accomplish the replenishment process, all DOD activities have automated requirements computation systems which track stock levels, requisitions, and procurement actions. When a shortage is detected, these systems will trigger buy notices, indicating that a procurement action is required. [Ref. 2:p. 159]

After buy notices are issued, requirement decisions regarding the spare parts are made. These requirements decisions are basically review actions by item managers to validate the data and make changes, as necessary. These review actions are validated and approved at higher management levels, based on the dollar value of the transaction. [Ref. 2:p. 159]

Once the review actions are completed and approvals are granted by the item manager, the buy notices result in purchase request documents. These purchase request documents are individually issued for each spare part. The purchase documents are vehicles to obligate funds, and to plan and authorize the procurement. [Ref. 2:p. 157]

The approved purchase request is sent to the contracting activity. At the contracting activity, contracting personnel release solicitations for the spare part requirements, evaluate proposals received from contractors in response to the solicitation, select the contractor based on selection criteria, and negotiate the prices of the spare parts with the winning contractor. Once the negotiations are complete, the contracting officer awards a contract, and ensures the spare parts are delivered in accordance with the terms of the contract. [Ref. 2:p. 158]

Budgeting constraints for support of existing systems are partially driven by the peculiarities of the Department of Defense Planning, Programming and Budgeting System (PPBS). Each Service must request from Congress sufficient funding to meet specific levels of readiness and availability set by the respective component head. The quantity of spares to be purchased is determined from historical data or from engineering estimates of the number of anticipated failures for a period of time. [Ref. 5:p. 9]

D. THE ARMY SPARE PARTS ACQUISITION PROCESS

The goal of the spare parts acquisition process is to ensure that our military forces receive timely delivery of the highest quality spare parts at the lowest cost to the taxpayer. [Ref. 6:p. 22] Within the acquisition process, there are numerous agencies and regulations which affect the buying of spare parts, as well as other items. For this reason, ordering of spare parts for these often complex systems in the inventory can be a very complicated process.

This research focuses only on replenishment of spare parts and not initial provisioning of spare parts. Replenishment refers to the process of restocking the spare parts inventory as the parts are depleted through maintenance and use. The item managers and contracting officers are the focal point for replenishment spare parts procurement. They must ensure that the required part is provided to the user in a timely manner and at a fair and reasonable cost. The past decade of seemingly unlimited resources is gone, and the military must return to days of more prudent procurement.

The Army develops and purchases its equipment principally through five subordinate commands which report to the Army Materiel Command (AMC). These subordinate commands each manage a particular commodity family such as missiles, aircraft and troop support equipment, communications and electronics, tank and automotive equipment, and munitions and chemicals.

The Army determines during the development phase of a system which parts it will repair and which parts it will stock to make those repairs. Some items may be catalogued but not stocked because their anticipated usage is so low that they will be bought on demand rather than held in inventory. The Army also purchases technical data packages (TDP) from the prime contractor which documents the configuration of the equipment. TDPs are used to competitively buy the replenishment spares. Some replenishment spare parts cannot be purchased competitively with these data, because the data are either proprietary to the contractor and the Army did not buy the rights to use it; the source of the item must be controlled to ensure safety or interchangeability; or the data is incomplete or otherwise unsuitable for competitive reprocurement. [Ref. 2:p. 113]

The technical data packages are usually not finalized and delivered to the Army until one to three years after the first production contract is awarded. Once the TDPs have been delivered and demand rates for the spares have been established, replenishment parts can be procured competitively using the technical data packages. [Ref. 2:p. 113]

The mission of the Army wholesale logistics operation is to make items available to the retail system by acquiring items for inventory through purchases from industry, fabrication, rebuild and overhaul, and cannibalization of unserviceable items in order to sustain the force. The Army

Depot Support Command (DESCOM) is responsible for the receipt, storage, issue, and maintenance of Army specific assigned commodities. [Ref. 7:p. 15]

The Department of the Army's standard wholesale logistics operation is performed by the Army Materiel Command and is managed through its Commodity Command Standard System (CCSS). The CCSS is an automated management system of secondary items (spare parts) and repair parts. The functional areas of the Commodity Command Standard System are provisioning, cataloging, supply management, stock control, financial management, procurement and production, and international logistics and maintenance. Data are accessible by all functional areas through the integrated data base. The data are stored by data elements in files. There are approximately 35 master files within the system. [Ref 7:p. 15]

Replenishment stockage is based on demand and quantity usage and is the responsibility of the stock control functional area. Demand history data are compiled in the Demand Return Disposal (DRD) file. The Demand Return Disposal file maintains data on requisitions, serviceable and unserviceable returns, and disposal actions from the field. These data entries are available through the processing of information through the Standard Intermediate Level Supply System (SAILS) and through the Standard Depot System (SDS). The SAILS is used by Corps/Installation level activities within the Army. The SDS links and integrates the functional areas within an individual depot, links one depot to another, and serves as a communications and data transfer network with the wholesale inventory system. The CCSS then uses the DRD file to compute average monthly demand rates and recommend future stockage levels based on past and anticipated requirements. [Ref. 7:p. 17]

As stated earlier, the item manager is one of the people responsible for the replenishment process. The item manager receives information from the CCSS and generates the Procurement Work Directive (purchase request). The Procurement Work Directive is then forwarded to the financial management, procurement, and production functional areas. The contracting officer will then award a contract using established procedures.

The Army is currently utilizing the Standard Army Automated Contracting System (SAACONS) to automate the work of procurement clerk, small purchase buyers, and contract specialists. SAACONS has been able to standardize procedures, reduce procurement lead times, provide more accurate and timely reporting, and reduce the backlog. Examples of procurement administrative lead time (PALT) reductions using SAACONS have been to provide a one to two day turnaround for customers' transactions that used to take two to three weeks. [Ref. 8:p. 38]

The focus of this study is at this point where the acquisition process fails to provide the required spare parts for the end user in a timely manner and at a fair and reasonable price.

E. SUMMARY

This chapter provided a background of the classes of spare parts: consumables and reparables, the general DOD procedures for the replenishment of spare parts, and the Army specific spare parts acquisition process. The following chapter will present the theoretical and analytical framework as it pertains to the nonavailability of spare parts.

III. THEORETICAL AND ANALYTICAL FRAMEWORK

A. INTRODUCTION

With the break-up of the Warsaw Pact and the dissolution of the Soviet Union, the pressure of rapidly advancing high technology weapons in the arsenals of potential enemies has also significantly lessened. Consequently, the need to replace existing weapon systems in order to maintain a significant technological advantage is no longer as urgent. As a result, we will be able to reduce concurrency in development programs and retain existing equipment for longer periods, with necessary technological advances incorporated more often through upgrades than through initiation of new systems. [Ref. 9:p. 2]

The Army has already cut four active divisions, and it will deactivate two more, bringing the total down to 12. This is the fewest number of active divisions in 42 years. The defense procurement budget is now one-half of what it was in 1985 in real dollar terms. Five years ago defense spending was 27 percent of the Federal budget. Next year it will be 18 percent. By 1997 national defense will be just 16 percent of the Federal budget. In the past three years, DOD has canceled or terminated more than 100 major defense programs. [Ref. 9: p. 4]

A commitment to the acquisition of a new major defense acquisition program will occur only when there is a definite need for the system and it is proven to be cost-effective. [Ref. 9:p. 6] New major defense acquisition programs will be examined closely, throughout their development, to identify critical components before the system goes out of production. Once criticality is determined for these components, the requirement for the item is generated to meet the Base Force peacetime demands and contingency-related demands within a specified period of time. Once the requirement is determined, the item's availability is calculated. A shortfall exists if the item's availability does not meet the known requirement. [Ref. 9:p. 13]

The preceding paragraphs have briefly stated a portion of the Revised Acquisition Approach presented to the House Armed Services Committee on April 28, 1992 by the Honorable Donald J. Atwood. [Ref. 9] The statement appears to give a good indication that equipment either presently fielded or soon to be fielded in the military Services will probably be around a lot longer than expected when first conceived. We will have to rely on various alternatives to meet the demands of the users to sustain our equipment in a full readiness posture.

The U.S. Army often needs to purchase small quantities of spare parts which are not readily available commercially or otherwise. The apparent reason these spare parts are not available commercially is that they are required in limited quantities and have only a military application. These low demand components are also competing for the declining defense dollars against important new major systems. As secondary items, spare parts will usually take a lower priority in the procurement process than major systems.

One important step to improve the acquisition process of these low demand, nonavailable spare parts is to try to identify them before a demand is generated. There appears to be many challenges to identifying and procuring spare parts for aging nonavailable components. Some of these challenges include: buying all the data needed for reprocurement, having a capability to manage the technical data received, challenging proprietary marking, ensuring technical data packages are complete and accurate, maintain current usage factors and requirements in order to optimize inventory levels, and determining which parts are truly critical to ensure a ready supply of quality products. [Ref. 2:p. 114] Throughout this thesis, these issues will be addressed and critiqued as to their importance to the spares acquisition problem.

This chapter will describe the theoretical framework found in the literature involving the U.S. Army force structure and reforms initiatives to the spare parts acquisition problems. The analytical framework section discusses a previous researcher's work, followed by an explanation of the Navy's Rapid Acquisition of Manufactured Parts (RAMP) program.

B. THEORETICAL FRAMEWORK

1. U.S. Army Force Structure

The Army shapes its forces to fulfill the U.S. need for a worldwide, sustained land combat capability. Its structure is carefully tailored within manpower and fiscal constraints to optimize warfighting capabilities against the multiple and varied threats to U.S. interests abroad. The Army is reshaping to respond globally to a wide range of contingencies, but we have retained the ability to reconstitute a larger force to respond in the event of escalation. [Ref. 1:p. 39] The Army Force Modernization is an essential component in achieving a power projection capability as the Army becomes smaller. It includes the integration of doctrine, organization, leader development, sustainment, and training programs with new equipment and product improved equipment. Fiscal constraints will prevent the Army from fielding the entire force with some items of equipment. As a result of these fiscal constraints, several older and less capable systems will remain in the force and will require a service life extension program to keep them in a position of readiness. [Ref. 1:p. 41]

In this era of sharply declining resources, a strategy of continuous modernization is still required. The Army cannot afford to satisfy every requirement with a new system or to execute all needed programs. There will be system shortfalls and force deficiencies which cannot be accommodated. The aim is to pursue near-term materiel solutions for the most critical battlefield deficiencies, and also ensure the development of leap-ahead, overmatching technologies for far-term (20-30 years) warfighting capabilities. The Army must allocate resources to ensure a proper balance between these two requirements. [Ref. 1:p. 45] As stated earlier, modernization in the near term will be accomplished by upgrading fielded equipment.

This study examines the resources provided to the force primarily by way of spare parts. One of the new initiatives currently being implemented is the acquisition and depot level repair of reparable secondary items utilizing stock funds instead of appropriated funds. This initiative is designed to make customers more cost conscious and bring Army procedures in line with proven cost-saving commercial practices. [Ref. 1:p. 69]

2. Spare Parts Acquisition Reform

Secretary of Defense Casper Weinberger introduced a ten-point plan on 25 July 1983, directing each Service and the Defense Logistics Agency to take actions to remedy the way DOD ordered and purchased spare parts. Each Service and DLA initiated programs in response to the Secretary's memorandum. [Ref. 2:p. 129]

The Army's plan, Spare Parts Review Initiatives (SPRINT), consisted of 76 initiatives covering a wide range of spare parts related subjects such as: personnel, pricing, competition, and automation. [Ref. 2:p. 15]

The Defense Logistics Agency implemented spare parts improvement initiatives throughout its organization. The baseline for DLA's reform activities is the memorandum signed by Secretary Weinberger. DLA managers visited contractors serving DLA with the goal of obtaining technical data to increase the number of competitive buys. DLA also implemented a number of changes to help buyers, such as, increasing staffs, implementing breakout programs, and improving data storage and retrieval required to process a buy. [Ref. 2:p. 14] DLA plays an important role since the Defense Logistics Agency Supply Centers manage, stock and purchase more than sixty percent of all the national stock numbered items in the Federal Supply System. Most of these spare parts are consumable items which are essentially stable in design. [Ref. 2:p. 4] DLA is also receiving responsibility for more spare parts each year from the Services, due to the fact that they are now operating the major DOD, formerly Service owned and operated, supply depots. Most of these spare parts are consumable with commonality among the Services, although, DLA is acquiring responsibility for some Service specific spares as well. [Ref. 11]

The Navy implemented Project Buy Our Spares Smart (BOSS) to improve their spare parts acquisition process. The BOSS program was specifically created to "monitor and coordinate" actions that would address the problems and system weaknesses in the material acquisition process. The primary objective of Project BOSS was to pay fair and reasonable prices for spare parts, yet maintain the highest possible state of readiness in the fleet. The early beginning of the Project BOSS program saw the drafting of some 112 initiatives designed to improve the acquisition of spare parts used by the Navy. [Ref. 12:p. 2]

The Air Force reform program was initiated prior to the attention focused on spare parts by the public. The Air Force released a report of the Air Force Management Analysis Group (AFMAG) which set out 178 recommendations covering every facet of the spare parts procurement process. [Ref. 2:p. 13] Each Service's and DLA's reform programs were involved in looking at what to buy, how to buy, and the price to pay, as it relates to spare parts. This study focuses on "how to buy or acquire" nonavailable spare parts.

3. Planning for Procurement

The contracting officer has a few contracting mechanisms available to him to assist in reducing the Procurement Administrative Lead Time (PALT) and other problems associated with the acquisition of small quantities of spare parts. They include:

- Basic Ordering Agreement (BOA): A written agreement that includes the contract provisions that will apply to orders subsequently issued under the agreement. [Ref. 2:p. 7]

- Indefinite Delivery Contracts: Includes three types of contracts: definite quantity, requirements, and indefinite quantity. [Ref. 13:p. 16-12]

An audit by the DOD Inspector General in August 1983 concluded that BOAs may be a perceived cause of some of the spare parts acquisition problems. [Ref. 2:p. 7] This is because orders under BOAs may be issued as priced or unpriced. BOAs with redeterminable price provisions allow contractors to set the price at the time of delivery - long after the order is placed. Therefore, there is little incentive to control costs in this kind of situation. [Ref. 2:p. 7]

Indefinite delivery contracts are used when schedules cannot be planned; hence, the quantities required and thier times of use, or both, are unknown. Definite quantity contracts provide for the purchase of definite quantities of items whose time of use is unknown. Requirements contracts provide for the purchase from one supplier of all of a buyer's requirements, for a stipulated time period, for specified items for a designated operation or activity. Indefinite quantity contracts provide for the delivery of a specific category of items for an agreed-upon period of time. [Ref. 14:p. 291]

4. Industry Perceptions

The problem with the acquisition of spare parts is not totally one-sided. Industry executives have testified before Congress on separate occasions to give their points of view on the matter. Some of the causes stated by industry officials include [Ref. 2:p. 36]:

- The lack of skilled personnel and the lack of sufficient Government funding.
- Requirements planning has been inadequate.
- Data have been insufficient to allow competitive reprocurement.
- Too often spare parts are bought in extremely small quantities.

Industry recommended using multi-year procurements for some items, utilizing in-house fabrication when it can be done at a lower cost, repairing more and buying less, and reducing pipeline time for investment spares. [Ref. 2:p. 36]

Representatives from the Aerospace Industries Association's Spare Parts Committee presented an industry action plan that supported the Weinberger initiatives. Some of the industry initiatives included [Ref. 2:p. 36]:

- Recommend buy-outs, that is buying enough spare parts to last for the remainder of the expected life of the equipment, of significant spare parts in conjunction with final production runs.
- Encourage use of commercial off-the-shelf spares when safety and performance are not compromised.
- Promote better procurement by refusing orders for less than economical quantities without specific instructions from the customer.

Other initiatives relating to policy and management, requirements, breakout, and pricing were proposed, but the initiatives listed above relate to this study. Most important seems to be a better cooperative Government-Industry relationship for a long-term improvement of spare parts acquisition.

C. ANALYTICAL FRAMEWORK

In December 1985, Lieutenant Elizabeth Ann Tracy, United States Navy, developed a decision model to assist contracting officers with a formalized procedure for selecting the most feasible available alternative to the microelectronic circuit component obsolescence problem. The decision model presented in her thesis, Component Obsolescence: Presentation of a Decision Process for Assessing and Selecting Alternative Solutions Applicable to Major Weapon Systems Production, utilizes a weighted method for analyzing and selecting between category alternatives depending on each particular situation. [Ref. 15:p. 90] In the context of her research, obsolescence occurred when the last known manufacturing source stopped producing a microelectronic component that is still needed to support a military weapon system in production. [Ref. 15:p. 14]

In her thesis, she grouped the possible alternative solutions into four categories: source solutions, engineering solutions, system solutions, and stockpile solutions. Each category described several alternative solutions to the component obsolescence issue. [Ref. 15:p. 31] The model provides a method for analyzing and selecting alternative solutions to the component obsolescence problem. The assignment of weights to each factor is a subjective process based upon an analysis of the issues. The choice of alternatives is guided, to a significant extent, by a combination of circumstances surrounding each particular situation. [Ref. 15:p. 90]

This research examines the acquisition of nonavailable spare parts for aging low density items. Since the items addressed in this study are out of production, many of the alternatives stated in Lieutenant Tracy's thesis are applicable to this study.

D. RAPID ACQUISITION OF MANUFACTURED PARTS

The Navy has implemented the Rapid Acquisition of Manufactured Parts (RAMP) program, which is designed to reduce the Navy's spare parts supply, stocking, and procurement problems by fabricating spare parts on demand, in small quantities, and at a reasonable cost. [Ref. 16:p. 6] This new approach is based on technological breakthroughs in computer-aided design (CAD) and computer-aided manufacturing (CAM), flexible manufacturing systems, and parts on demand or just-in-time procedures. The RAMP program is designed to communicate parts requirements and specifications to manufacturing activities using computer data-driven manufacturing technology in order to increase readiness and reduce costs. [Ref. 16:p. 11]

RAMP will utilize CAD technology to develop an extensive inventory manager data base that will contain the digitized design specification necessary to manufacture spare parts. This data base information will then be utilized by companies with CAM machinery to produce the spare parts. [Ref. 16:p. 6]

Another facet of the RAMP program is the capability of an automated order and bidding system which will provide an on-line order entry and eliminate the paralyzing flow of paperwork. There will also be a reverse engineering capability which will permit technical and geometric data to be reconstructed almost instantaneously from parts having incomplete data. [Ref. 17:p. 26]

The feasibility of incorporating this system into the Army acquisition of nonavailable, aging, low demand spare parts, will be explored later in this thesis.

E. SUMMARY

This chapter provided a brief overview of the theoretical framework of the future Army base force structure, spare parts acquisition reform, procurement planning, and industry perspectives. The Army force structure discussed the intent to retain existing systems in the service for a longer period of time than initially conceived. The spare parts acquisition reform discussed the initiates each Service and DLA implemented due to the OFPP report to Congress in 1984. Procurement planning and the industry perspectives described contracting mechanisms and industry recommendations to follow through on the initiatives presented in the OFPP report as they pertain to the acquisition of spare parts.

The analytical framework section discussed previous research in the area of the component obsolescence of microcircuits. This was followed with a discussion of the Navy's RAMP program.

The following chapter will present the perceived causes to the spares procurement problems, the two aging, low density items specifically evaluated for use as examples in this study, and the data collected through the use of a survey questionnaire and personal and telephone interviews.

IV. DATA DISCUSSION

A. INTRODUCTION

There appear to be several systems in the Army that were not meant to remain in the inventory for as long as they have. These systems have been out of production, in some cases for decades, but still retain a valid mission in the Army, and must therefore be maintained in a state of readiness. This means that repair and spare parts must be acquired to maintain these out-of-production items in the necessary state of readiness.

The first part of this chapter will identify the perceived causes of nonavailable spare parts. The second part of this chapter will identify the systems and their major components that will be evaluated for this study. The third part of this chapter will address the viable acquisition alternatives to resolve the nonavailabilty problem. The last part of this chapter will review the questionnaire utilized by the researcher to attempt to obtain a knowledge base and consensus as to the alternatives used and their frequency.

B. PERCEIVED PROBLEMS TO SPARES PROCUREMENT

Throughout this study, a primary objective was to determine the most significant factors or causes to the nonavailability of spare parts as perceived by Government officials. There was thought to be numerous factors involved at the start of this research, but in fact, according to interviews and questionnaires, there are only a few major factors which create the problem of nonavailability in the acquisition of spare parts for aging equipment. These factors are: out of production items, lack of adequate technical data packages and poor visibility of the system within the Army. Each of these are discuss·d below.

1. Out of production items

This factor involves several different explanations. It would seem reasonable that if an item is out of production, one only need contract out to have it produced. Unfortunately it is not all that simple. A system will only be in production for a limited amount of time, afterwhich, the original manufacturer ceases production of the system as well as its spare parts, on a continuing basis. In most cases military equipment must be supported for at least ten to twenty years after fielding, with spare parts, depending on the type of system. [Ref. 18]

The problem presents itself in different ways. First the original equipment manufacturer (OEM) may no longer produce the component and does not want to produce the component, because it is either no longer economically profitable or the part is technically obsolete and the OEM would rather upgrade the system with a component more technologically advanced.

Another factor could be the original equipment manufacturer has gone out of business and failed to identify the original subcontractors, making it virtually impossible for the Government to find them. Even the subcontractors could have gone out of business, in which case, the necessary skills to produce certain items have been lost. [Ref. 19]

2. Lack of adequate technical data packages

The most frequent factor that caused spare parts acquisition problems, as disclosed by both item managers and contracting officials interviewed for this thesis, was the nonavailability of sufficient technical data packages (TDP). Insufficient technical data packages resulted from either the Government never having purchased the data to start with, due to the extremely high cost associated with the data, or the available copies of the technical data packages are illegible.

If the technical data packages are restricted due to proprietary information and the Government has not purchased the data, then the Government will not be able to use the TDPs to compete the future production of the spare parts. There were cases, reported through the questionnaires, where the Government sought to purchase the technical data packages for a system from the original manufacturer a decade after production had ceased. The cost of the data was more than the

Government expected to ever spend on the components for the remaining life of the system. The original manufacturer, however, refused to produce the components due to obsolete technology.

There were also cases in which copies of the TDPs were so old, that sections of them were no longer legible. This caused severe delay problems as the data were recreated. Another serious problem encountered was the fact that many technical data packages are not kept up to date. So, when a requirement is generated for a component, time is consumed making changes to or updating the TDPs.

3. Poor visibility of the system within the Army

As expected, large dollar items receive much more visibility in the press and with policy makers than do smaller, low density items. Due to this lower level of visibility, resources are not made available to maintain these low density systems in the best readiness posture. This factor was commented on by several item managers and contracting officials during personal interviews.

As stated in previous chapters, this problem is only going to worsen with the drawdown in the military. There will be more and more systems remaining in service for extended periods with fewer dollars to maintain them. The capabilities to provide spare parts for these aging items will demand a careful analysis of existing acquisition alternatives to fill the requirements as expeditiously as possible.

C. ITEMS AND COMPONENTS EVALUATED

For this study, the researcher selected components from a couple of very low density systems managed by the troop support side of the Aviation and Troop Command (ATCOM), to illustrate the problems and possible solutions to the acquisition of nonavailable spare parts. The systems selected include the M1945 Mobile Field Bakery Plant and the Light Air Cushioned Vehicle - 30 (LACV-30).

1. M1945 Mobile Field Bakery Plant

The M1945 Mobile Field Bakery Plant, hereinafter referred to as the field bakery, was initially fielded between 1950 and 1964. Thirty four field bakeries remain in the Army inventory (active, reserves, and national guard) and six in the United States Marine Corps inventory. The Army completed an on-condition maintenance (OCM) program in fiscal year 1991 on all M1945 field bakeries. The purpose of the OCM was to bring all of the field bakeries up to a deployable status and extend their service life for an additional five years. The OCM resulted in the redesign and upgrade of several components and assemblies of the field bakery. As part of the base force, the number of operational field bakeries will be reduced to 10 from the current 34. There will be four in the active Army and six in the reserves. [Ref. 20]

The critical nonavailable components of the field bakery that were evaluated for this study include the blower motor fans (also referred to as squirrel cage fans), electrical power outlets, burner carburetor, and dough drum plunger and knife. Each of these components have caused significant acquisition, logistical, and readiness problems.

The blower motor fans are designed to move the hot air through the heating tubes within the oven to bake the bread. The blower motor is a component managed by the Defense Logistics Agency (DLA). DLA has been unable to support the demands for the blower motor fans. [Ref. 20] There were no known commercial contractors or substitutes available for the fans, so a using unit contracted a local specialty house to fabricate a few fans using an old fan as a model. A serious problem arose due to the wrong material being used for the fans. The fans melted due to the heat from the diesel burners. The problem has since been corrected using proper material. The electrical power outlets are designed to receive the power from the generators to the field bakery plant. The outlets are the identical outlets used on the Air Force B-52 bomber, therefore, since the field bakery has a much lower priority for requisitions, they were not receiving the needed component. In addition, the plugs were priced extremely high due to the demand for the B-52 bomber. [Ref. 20]

The burner is designed to produce the heat required to bake the bread. The burner was originally designed to use gasoline, however, DLA purged the original carburetors for the burner from the system, and attempted to substitute the same type of carburetor used for the tent stove. The original carburetors were no longer available and the substitute item would not function with the bakery. [Ref. 20]

The dough drum plunger and knife work in unison on the field bakery. The plunger will push the dough into the specially designed knife which will then cut the dough into two pound blocks which are then rolled and formed into two pound loaves for baking. Due to the low demand for the plunger and knife, unit cost for the component for a small order is upward of $32,000. The problem has been finding a contractor willing to produce them, due to the required materials. [Ref. 20]

2. Light Air Cushioned Vehicle

The LACV-30 was initially fielded in 1982 with a total of 26 in the Army inventory. The LACV-30 is a light air cushioned vehicle (hovercraft) designed to transport 30,000 pounds of equipment at one time from ship to shore. The LACV-30 is a U.S. military version of a commercial hovercraft designed by British Hovercraft. Therefore, the technical data packages have three owners: British Hovercraft, Textron (the American contractor), and the U.S. Army. [Ref. 18]

The critical major nonavailable components for the LACV-30 that were examined for this study include the landing pads, skirt system, low pressure bumper system, and the gear box for the auxiliary power unit (APU) turbine engine. Each of these critical components have presented significant acquisition, logistics, and readiness problems in the past for the item manager and contracting officials. The original equipment manufacturers are unwilling to produce the last three components listed above. The stated reasons for the OEMs not willing to manufacture the components were that the components were obsolete, low demand, and military specific. [Ref. 21]

The landing pads are designed to handle the 30,000 pound load on various terrains, however they do not last as long as they were designed. Therefore, replacements are frequent and not cost effective, since we still have to purchase the original design. Currently a redesign effort is underway to improve the landing pads and upgrade them to a 50,000 pound load capability. Textron owns the technical data rights, so the landing pads have had to be procured on a sole source basis for now. There has been very little subcontractor interest in competing for contracts, due to little commercial application of the design. [Ref. 22]

The skirt system is designed to allow sufficient air flow under the vehicle to levitate it above the surface. The TDPs for the skirt system are owned by all three parties:

British Hovercraft, Textron, and the U.S. Government. This arrangement has caused significant problems, as each organization claims technical data rights. Currently the skirt system is being maintained by patching the holes. New components are not available from any known source. [Ref. 21]

The low pressure bumper system is used to keep the LACV-30 from damaging the vehicle while it is along side another ship. There is no known supplier for this bumper system, since the OEM refuses to produce it. The OEM will not produce the component since it is a military peculiar item with a low demand and has no commercial application. [Ref. 21]

The gear box for the APU turbine engine is no longer in production and not available from any known source. They are being maintained by overhauling the components to the best of depots capabilities. A new prototype is currently under development. [Ref. 21]

The field bakery and LACV-30 major nonavailable components were utilized in this study as examples as to the problems that exist and the possible acquisition alternatives to resolve these problems. There are many other low density items in the Army inventory, in every branch, that could have been used for this study, but time constraints limited the scope of this research.

D. ACQUISITION ALTERNATIVES

This section will provide a discussion of the most relevant acquisition alternatives available to item managers and contracting officers when there is a demand for a nonavailable component of an aging system. The alternatives identified in this study were selected from Lieutenant Elizabeth Tracy's thesis, depending on their relevancy to the acquisition of aging nonavailable spare parts. [Ref. 15] Lieutenant Tracy presented fourteen alternatives in her thesis, and of those fourteen, this researcher has selected nine to represent the most viable alternatives for the acquisition of aging nonavailable spare parts. For this study, the alternatives are grouped into three categories:

1. Sourcing Alternatives
    a. original equipment manufacturer
    b. Government locates or develops a new source
    c. in-house fabrication
2. Engineering Alternatives
    a. commercial or nondevelopmental item substitute
    b. redesign
    c. reverse engineering
3. Supply Alternatives
    a. provide next higher order of assembly
    b. cannibalize depot items
    c. stockpile with a life-of-type quantity buy

The sourcing alternatives principally involve contracting functions, while the engineering and supply alternatives require contracting, item manager, and higher Governmental level interaction to successfully complete the requisition.

1. Sourcing Alternatives

a. Original Equipment Manufacturer (OEM)

In most cases, the preferred method of acquiring spare parts for systems that are out of production is to return to the original manufacturer. This is because the OEM usually maintains and has the rights to the technical data package and also has the best chance of having maintained the skilled workforce to produce the parts, thereby, providing the fastest turnaround time for the sourcing alternatives. A problem discovered with the field bakery was that the OEMs are no longer in business for many of the critical components, due to the system's age. [Ref. 11] For the LACV-30, the OEMs for its critical components either no longer want to make the spare parts or want to charge such an outrageous price for the parts that it is no longer cost effective. [Ref. 22]

b. Government Locates or Develops a New Source

Usually when a system is older and has been out of production for several years, it is highly unlikely that there is another source for spares readily available. The location and development of a new source can mean the following: an identified subcontractor to the OEM or a specialty house that has the capabilities to fabricate spare parts on demand. Most importantly for the Government to locate and develop a new source, it must own the technical data package for each component. Without the TDPs, the Government's last resort is to locate a source that has had the foresight to purchase old spare parts as scrap from the depots and then warehouse them with the hopes that there will be a demand from the Government for the spares in the future. [Ref. 22]

c. In-House Fabrication

In-house fabrication may take several different forms. These include either Government Owned-Government Operated (GOGO) facilities or Government Owned-Contractor Operated (GOCO) facilities. [Ref. 15:p. 34] GOGOs are primarily the Government's maintenance depots operated by each Service. It would seem logical for all Army maintenance depots to have limited capabilities for in-house fabrication. This would permit them to produce needed repair and spare parts during overhauls almost immediately. In-house fabrication of components requires a memorandum of understanding between the contracting command and the fabrication organization for purposes of payment. [Ref. 19]

2. Engineering Alternatives

a. Commercial or Nondevelopmental Item Substitute

A commercial substitute is the replacement of an items' component with a commercially developed component which performs the same or similar function. Nondevelopmental items (NDI) are normally selected from commercial sources, materiel developed and in use by other United States military Services or Government agencies, or materiel developed and in use by other countries. [Ref. 23:p. 17.1] One of the recommendations of the President's Blue Ribbon Commission on Defense Management, in June 1986, was that "...DOD should make greater use of components, systems, and services available off-the-shelf." [Ref. 24:p. 60] This recommendation has been translated into the new DOD Instruction 5000.2 policy which states: "...materiel requirements shall be satisfied to the maximum practicable extent through the use of nondevelopmental items when such products will meet the user's needs and are cost-effective over the entire life cycle." [Ref. 3:p. 6-L-2]

Utilizing a commercial substitute will also require the time to qualify the component in the system. This could take anywhere from weeks to months to complete, depending on the complexity of the item. The problem of the electrical power outlet for the field bakery was rectified by procuring a commercially available substitute. Not only was the commercial substitute much cheaper, it has proven to be more dependable. [Ref. 20]

b. Redesign

Redesign involves changing the design of either the component or the subsystem with which it interfaces to allow the introduction of technology considered more enduring than the older technology. [Ref. 15:p. 47] The redesign of a component may entail further redesign or reengineering of higher assemblies or subassemblies to allow the component to interface properly with the system. This alternative has allowed the introduction of new technology into a system, but also usually creates longer delays initially due to additional development testing requirements. Redesign provides long term benefits, since it modernizes the system and usually provides the Government with the data rights to the upgrade for further production requirements. [Ref. 18]

The skirt system for the LACV-30 is currently undergoing a complete redesign. [Ref. 21] Several components of the field bakery also had to be redesigned due to the lack of available parts. Redesigned components included the incorporation of a commercial substitute for the electrical power outlets and deletion of the burner carburetor by using an alternate fuel. [Ref. 20]

c. Reverse Engineering

When the technical data package is not available, for whatever reason, and the spare part required must meet the exact form, fit, and function, it may have to be reverse engineered. Like the redesign alternative, reverse engineering will cause longer delays initially, but the long-term benefits will be Government ownership of the TDPs and possibly increased competition with shorter lead times.

The low pressure bumper system, skirt system, and the landing pads for the LACV-30 are presently under-going reverse engineering. Problems such as the stalled proposal for the reverse engineering of the landing pads can increase the delay of delivery and seriously affect the maintainability of the system. The reverse engineering effort for the skirt system is under contract by the U.S. Navy, which should help expedite the effort and ensure a quality product, due to the Navy's experience with this type of product. [Ref. 21]

3. Supply Alternatives

a. Provide the next higher order of assembly

The DOD and Army supply systems should maintain an appropriate number of spare parts in the inventory to support a piece of equipment throughout its life. When contracting officials inform the item manager that a required component is not available from a known source, depending on the urgency of the requirement, the item manager may cancel the requisition and inform the user to order the next higher order of assembly that contains the needed component. Thus the user must pay for the more costly higher order of assembly, instead of the single component that is required. This has been the case on components for the field bakery. There was a requirement for a handle on an oven door, in which the user had to order the entire oven door just to get a new handle. [Ref. 20]

b. Cannibalize depot items

Cannibalization is the process of taking spare parts or subassemblies needed for replenishment from existing systems stored at the depot level or even from local systems, when available, that are already inoperable due to the lack of available spare parts.

According to the responses of the questionnaires and personal interviews, cannibalization was one of the most frequently used alternatives to the problem of nonavailable spare parts. It was never the preferred method by any activity, but always resulted in the most timely response to the demand.

Cannibalization has been utilized for both the field bakery and LACV-30 as a short-term fix until needed components can either be reverse engineered and then produced, or until a commercial substitute can be located, tested and approved for use.

c. Stockpile with a Life-Time Quantity Buy

A life-of-type buy is the one-time purchase of enough components to completely support the system for the remaining life of the item. It is also referred to as a "buyout". [Ref. 15:p. 59] It is DOD policy that a life-of-type buy for a quantity of secondary items no longer being produced shall be made only when all other more economical alternatives to a material shortage or manufacturing phaseout have been exhausted. [Ref. 25:p. 1]

This alternative was utilized for the dough drum plunger and knife for the field bakery. Only when the contractor was assured of producing a sufficient quantity did he accept the contract. Due to the fact that the Army ordered 50 plunger and knife sets, the unit price for this component was reduced from $32,000 to approximately $6,000.

E. QUESTIONNAIRE DATA

This section is a compendium of responses resulting from telephone and personal interviews collected through the use of a survey questionnaire. The questionnaire was directed to various item managers and contracting personnel within the Aviation and Troop Command (ATCOM). The questionnaire was developed based on an analysis of current literature, discussions with a faculty advisor, and discussions with Army officials who have the responsibility for supporting the demands from the users. The questions were left open-ended with the idea of promoting responses which would lead into meaningful issues for further discussions. The participants of the survey were informed as to the nature of the study and advised that all comments received by the researcher would be kept on a non-attribution basis.

The data presented are not evaluated for statistical significance nor do they apply to all DOD activities, but they represent a sample of the issues and problems experienced by the participants. The format for presentation of the questionnaire is comprised of groupings of related questions based on subject matter. A copy of the questionnaire is presented in Appendix C. Major issues that were identified by the participants are analyzed in Chapter V.

1. Nonavailability Issues

The first set of questions were to orient the researcher as to the items managed or contracting support provided, whether there was a significant problem with component nonavailability, and the major problems encountered.

The respondents were item proponents, material managers, item managers, contract specialists, and contracting officers for various combat service support items. A large portion of the respondents, approximately 50 percent, indicated they did not have a problem with component nonavailability. This was due to the fact that their items were mostly higher density and/or the Army maintained the Level III technical data packages for the majority of the items they managed, which allowed for sufficient competition. High density items are those systems with an inventory level in the Army that generate a sufficient demand as to not create a component nonavailability issue.

Those respondents that indicated significant problems of component nonavailability listed the causes as:

- system is out of production with little or no logistical support provided by contractor
- original equipment manufacturer has gone out of business

- original equipment manufacturer or other contractors have no interest in producing the components due to the age of design

- set-up costs for contractors make it cost prohibitive to produce the needed components

- lack of sufficient or updated technical data packages for adequate competition

- supply of components have been purged from the inventory due to low demand and sold as scrap

- vendors unable to locate components due to parts numbers having been changed

- lack of well developed failure rates for components have caused a faster depletion of the available supply

- termination of existing contracts

2. Identifying Demand for Nonavailable Spares

The second set of questions requested the current methods utilized for identifying the demands for spares and how nonavailable spares could be identified prior to demand.

The Army utilizes several plans and reports to provide the item managers with ways of identifying the future needs of the systems they support. The contracting officials get involved once they receive the Procurement Work Directive (PWD) from the item manager. According to the respondents, the plans and reports listed below are their identification methods:

- Distribution Plan - identifies the requirements and the schedule for the fielding of a system.

- Total Army Equipment Distribution Plan (TAEDP) - provides information for long range planning for distribution and new acquisitions.

- Army Requirements System for Initial Provisioning (ARCSIP) - computes requirements for initial provisioning by estimations of failure factors and end item density.
- Requirements Determination and Execution System (RDES) - computes replenishment requirements primarily based on average monthly demands and leadtimes.
- Major Item Requisition Validation (MIRV) - a monthly product provided to item managers that identifies requisitions in priority sequence.
- Requirement Validation - a two year report that looks at on hand stocks, what is needed now, and the projected demand.

Other methods mentioned for identifying the requirements for components of aging equipment prior to their need include:

- regular review of the Inventory Management Processing Code (IMPC) for the spare part, which reflects the condition of the major end item
- require contractor notification to Government when they are going to stop production of components
- development of a more precise failure rate schedule

3. Alternatives for Resolving Nonavailability

The third set of questions involved alternatives used to resolve component nonavailability issues in the past, the average delay times due to the component nonavailability problem, frequency of nonavailability, and if these nonavailable components were in fact critical.

The alternative solutions to the component nonavailability problem were varied depending on the age of the system, density of the system, stability of design, and costs of alternatives. Listed below are the compilation of alternatives indicated by the respondents. The alternatives are prioritized by their utilization frequency reported.

1. cannibalization
2. redesign
3. commercial or nondevelopmental substitute
4. next higher order of assembly
5. reverse engineering
6. original equipment manufacturer
7. Government locates or develops a new source
8. life-of-type quantity buy
9. in-house fabrication

Another alternative that was cited, although it is not actually viable, was to cancel the requisition and just inform the user he would have to do without until a new system was acquired to replace the old system. This occurred in one case where a component was deleted from the system before a replacement was developed.

The delays for nonavailable components ranged from four months to more than two years, on average, with some delays reaching five years. Requirements for nonavailable components occurred primarily on a monthly or quarterly basis for almost every system reported. Approximately half of the respondents indicated that some of the components they managed and were considered nonavailable, were in fact critical to the system.

4. Correcting Nonavailability Problems

The fourth set of questions involved the evaluation criteria used to select the best alterative, the respondents' views as to recent improvements with the component nonavailability problem, and any recommendations to rectify those problems which were not being corrected.

The responses to the evaluation criteria used to select the best alternative or solution included only a few choices. The two primary considerations were available funding and delivery schedule. The other criteria mentioned, to a much lesser degree, were past performance, and availability. The past performance criteria includes evaluating the contractors performance on previous contracts for similar items. Factors evaluated for past performance were quality of products, and meeting delivery schedules. The availability criteria involves the immediate access to contractors to perform the work. In many cases the Government must locate or develop new potential contractors.

The respondents' opinions as to areas of recent improvements, and those areas needing improvement, resulted in more of an inclination by the participants to indicate what needed improving versus what has improved. The recommendations for needed improvements included:

- Require more frequent updates and reviews of TDPs.
- Procure TDPs up front with the initial acquisition.
- Keep limited production on-going if demand permits.

- Modularize components for technology push replacements.
- Implement better communication channels between Commodity Commands, DLA, and users.
- Ensure all systems have an Authorized Stockage Level (ASL) and a Prescribed Load List (PLL).
- Place insurance codes on critical components of low density items to prevent systematic disposal of the components at the depots.
- Require contractors to give sufficient advance notification when they are going to stop production on a particular component to allow the Government time to locate an alternate source.
- Ensure an adequate supply of spare parts for at least 15 years.

5. Service Life Extension and Technical Data Packages

The fifth set of questions asked about current plans for extending the service life of the items, the availability of adequate technical data packages, and the perceived factors of the supply problems causing component nonavailability.

The LACV-30 has a service life extension planned for fiscal year 1997. This includes upgrading the system to a LACV-50, so it can handle 50,000 pounds of cargo, with an ECP for the landing pads. [Ref. 18] The field bakery plant just completed its on-condition maintenance to extend its life for five years. [Ref. 20] The majority of the other systems reported continual upgrading by deleting obsolete or nonavailable components and incorporating technologically advanced components in their place.

The Level III technical data packages were available for the majority of the systems. The problem is that the TDPs are restricted by the original equipment manufacturer, so the Government does not have the right to compete the procurements. When TDPs were not available, the alternatives were either redesign, reverse engineering, commercial substitute, provide the next higher assembly, or cannibalization.

The respondents' perceived factors of the supply problems causing component nonavailability included:

- lack of available contractors/manufacturers
- low density/low visibility of systems
- infrequent updating of technical manuals
- lack of communication between item managers and depots
- insufficient notice to procure out-of-production spare parts

6. Other Acquisition Methods

The sixth set of questions asked respondents if they were aware of other acquisition methods utilized by other Army agencies or other Services, and whether foreign sources were permitted or encouraged to compete for award of the contract. If foreign scurces were not involved, respondents were asked to identify the limiting factors.

Knowledge of other agencies' or Services' methods or initiatives to improve the component nonavailability issue was nonexistant among the respondents. Only one respondent replied with a positive answer. He was aware of another agency ordering nonavailable components utilizing the commercial parts numbers, which are much easier to cross-reference within an industry, and by-passed some of the normal Government bureaucracy.

Only components for the bridge erection boat were identified by respondents as being regularly provided by foreign contractors. This is due primarily because the item was manufactured in the United Kingdom and the majority of spare parts and repair parts are provided by sole source contractors in the United Kingdom. Only a few of U.S. contractors have been located that can compete for certain components and they are included in every solicitation to encourage some limited competition.

There was no response as to why foreign competition was never encouraged for nonavailable components, except that it was too difficult.

F. SUMMARY

This chapter provided the data presented to the researcher during the conduct of the study. Presented in this chapter were the perceived causes to spare parts procurement problems, the two major systems components that were evaluated, the nine acquisition alternatives studied, and the responses to the survey questionnaire utilized for this study.

The procurement problems or impediments fell into three categories: the item is out of production, the lack of technical data packages, and poor visibility of the system within the Army.

The two major systems components that were evaluated and used as examples were the M1945 Mobile Field Bakery Plant and the Light Air Cushioned Vehicle - 30. These two extremely low density systems displayed good examples of the component nonavailability problems.

The acquisition alternatives presented fell into three categories: sourcing alternatives, engineering alternatives, and supply alternatives. There were three alternatives studied for each category. The last section presented the responses to the survey questionnaire in six groupings, according to the format of the survey.

The next chapter will present the possible advantages and disadvantages to the various alternatives for different situations and an analysis of the questionnaire responses.

V. ANALYSIS OF THE DATA

A. INTRODUCTION

This chapter presents an analysis of the information and data presented in the previous chapters. The chapter begins with a presentation of the advantages and disadvantages of each alternative presented in Chapter IV. The next section will present an analysis of the responses from the survey questionnaire and interviews by first stating the set of questions then presenting an analysis.

B. ALTERNATIVES: ADVANTAGES AND DISADVANTAGES

The advantages and disadvantages of each of the three groups of alternatives will be discussed as they were presented in Section D of Chapter IV: sourcing alternatives, engineering alternatives, and supply alternatives.

1. Sourcing Alternatives

a. Original Equipment Manufacturer

Producing aging components might not appeal to any potential contractor if economic conditions are favorable. They may prefer to concentrate on more lucrative commercial business or state-of-the-art technologies. This is just as true with the original equipment manufacturers as with other potential contractors. The advantages of staying with the OEM ensure maintaining the required quality; availability of technical data packages so the components meet the form, fit, and function requirements; known past performance; and that of a readily available source.

The most notable disadvantage to contracting with the OEM for out-of-production components is the higher cost associated with a sole source. The Government must usually incentivize the OEM, through increased profits, to continue to produce low demand spare parts.

b. Another Source

Determining why a contractor no longer plans to produce a particular component is usually the contracting officer's responsibility under the one-face-to-industry concept. Listed below are a couple of apparent reasons why an OEM might refuse to produce an item and force the Government to locate or develop another source.

- inability to justify continued production of a component which is totally obsolete in the commercial market [Ref. 15:p. 34]
- demand is so low for military specific components which makes production of the items cost prohibitive or just unattractive [Ref. 15:p. 34]

An article, written by Dr. David Lamm, reported the results of a study to determine why companies actually refused DOD contracts. The findings resulted in 25 frequently cited reasons for refusing DOD business or for voicing dissatisfaction with the Federal acquisition process. [Ref. 26:p. 49]

When the original manufacturer will no longer produce a spare part, the Government first tries to either locate or develop a new source as an alternative. Locating an alternate source may be easier if the prime contractor identifies the subcontractors that actually produced the component. This could be done by contractually requiring the prime contractor to disclose all subcontractors and the specific components they produce.

Lack of success in locating a suitable source causes the problem to be raised to a higher Government management level where consideration is given to relaxing the specifications, modifying the requirement, or developing a new source. [Ref. 15:p. 35] Developing a new source could take one to two years, since the Government must qualify the new contractor.

There are also several sources available who specialize in out-of-production spare parts. There are sources that procure supposedly obsolete spare parts as scrap from Government depots and then store the parts with the hopes that the Government generates a requirement for the part in the future. The source will then sell the component back to the Government for a substantial profit, yet much lower than would be paid if the Government had to produce the item again. [Ref. 22]

The advantages of locating or developing a new source or sources include increasing competition, expansion of the industrial base, and ensuring stability of design. The disadvantages include the cost and time associated with locating, developing, and qualifying a new source and the availability of adequate technical data packages, which could lead to unintentional configuration changes due to uncertain component composition. [Ref. 19]

c. In-House Fabrication

Every Army maintenance depot has a limited in-house fabrication capability to assist in improving their depot level maintenance support (overhaul) provided to the user. With possibly limited investment, this in-house fabrication capability may be able to provide a more extensive spare and repair parts production resource. This capability may be viewed as a short-term solution, to ensure supply until redesign of the component is complete and can be contracted out competitively or the item is phased out of the inventory and replaced with a new system.

Government in-house fabrication capabilities may benefit from a Rapid Acquisition of Manufactured Parts (RAMP) type program. With the investment in computer-aided design and computer-aided manufacturing technology for GOGOs and GOCOs, Government depots would be able to produce a large variety of components on demand. This would be most beneficial for systems with a somewhat stable design, such as, aging low density items.

The advantages of in-house fabrication are the permanency of the source and lower long-term costs. The disadvantages include an initial costly investment to establish the advanced fabrication capabilities, particularly RAMP, and the availability of adequate technical data packages.

2. Engineering Alternatives

a. Commercial Substitute

The availability of a commercial substitute may depend in part on the complexity of the component or system. The more complex the component or system, the more likely that a suitable substitute will not be found.

One of the advantages of a commercial substitute or nondevelopmental item is that a check for availability can be performed in a relatively short time compared to other alternatives. A commercial or NDI substitute may also very well be the least expensive alternative available. Another advantage is that a substitute usually does not disrupt the configuration of the system. A disadvantage is finding a commercial substitute that meets rugged military standards. A nondevelopmental item from an allied country may meet U.S. military specifications. Another disadvantage is you are not assured of good logistical support. This means that when the contractor stops producing the item due to new technology, acquiring the old component may be difficult. Due to the significant advantages, the researcher feels commercial or NDI substitutes may be an early alternative solution to component nonavailability.

b. Redesign

Any engineering solution will require consideration of the potential disruption it will cause to the overall system. Engineers will want to reduce this disruption as much as possible. Configuration control involves the systematic approval or disapproval of proposed changes to the design and construction of an item whose configuration has been formally approved. [Ref. 15:p. 48] Redesign will affect configuration and therefore requires formal approval and documentation. These configuration changes are accomplished through the use of Engineering Change Proposals (ECP).

The main advantage of redesigning a component or subsystem is the opportunity to incorporate state-of-the-art technology into the system. This is one of the stated goals for the modernization of Army equipment. [Ref. 1:p. 46] The one primary disadvantage of a redesign alternative is a lengthy time for incorporating the change into a fielded system, due to development, testing, and production requirements. Consideration must be given to the long-term plans for the system before embarking on a redesign. If the system design is fairly stable and expected to remain in the inventory for some time, then redesign of a component may be a viable alternative. The time factor will also increase the cost involved. Due to configuration changes, added costs, and time involved, this researcher feels that redesign should possibly be the last alternative considered.

c. Reverse Engineering

Reverse engineering does not involve configuration changes as does redesign. The expected service life of a system must also be analyzed before undertaking reverse engineering, since it usually requires at least two years to complete before providing the user a new component. The design of the system must also be stable.

An advantage of reverse engineering includes providing the Government with the technical data packages to competitively acquire the components in the future, which will assist in reducing the costs in the long run, and ensure design stability. The disadvantages are the long lead times required to complete the reverse engineering, test, qualify, and produce the component, the immediate high costs to perform the reverse engineering, and the lost chances of employing technological upgrades.

3. Supply Alternatives

a. Next Higher Order Assembly

The advantage of providing the user with the next higher order of assembly is that of almost immediate response to the demand. When a component is determined nonavailable through sourcing alternatives, the next higher order of assembly will provide the user with the required component most expediently. The disadvantage of providing the next higher order of assembly is the cost to the user. The price of a single component versus that of the next higher subassembly can vary greatly. With the already limited budgets of Army units, this method could be detrimental to an organization's financial situation.

b. Cannibalization

When faced with a critical demand requirement, the option of cannibalization may appear very attractive. Cannibalization is used for a number of reasons including: operational commitments, material shortages, supply response time, readiness reacting, risk avoidance, trouble shooting, or maintainability of design. Cannibalization is an expression of a failure somewhere in the logistic system. [Ref. 27:p. 47] Cannibalization delivers to the item manager a timely component that is ready for use with a minimum amount of effort. Cannibalization can improve readiness in the short-run, but will ultimately destroy readiness in the long-run. Components and repair parts will eventually run out. With aging systems, it is understandable that in some instances, cannibalization must be used. It's use must be tempered with sound judgment, until an alternative is created to resolve the problem.

Although cannibalization was used frequently by the respondents to the questionnaire, all participants stressed that it does not solve the problem satisfactorily and should be used only as a short-term solution. Cannibalization should not be construed as a normal supply procedure taken to satisfy user requirements. Most respondents referred to cannibalization as "disassembly of an end item" in order to make it sound less disturbing.

Advantages of cannibalization are: immediate availability of critical components and the low cost of components. The main disadvantage is that the solution is short-term, since eventually you will run out of systems to cannibalize. There is also wasted manhours by doubling the work that takes place, since every time a component is cannibalized, two component removals and two component installations are required. This will only compromise readiness in the long run.

c. Stockpile with a Life-of-Type Quantity Buy

It seems very apparent to this researcher due to personal experience, that the Army has rarely been capable of accurately determining the equipment life span. The advantages of stockpiling with a life-of-type quantity buy include having components available instantly upon receiving a demand and placing an economic order quantity (EOQ) to receive the best possible price from the contractor. The disadvantages of a life-of-type quantity buy include obtaining sufficient funding for the buy, determination of an accurate buyout quantity, and the costs and shelf-life considerations of storing the components. A life-of-type quantity buy requires a large initial outlay of money versus buying in smaller quantities over an extended period. There are also the costs of storing the items in depots, which DLA charges to the customer. One additional disadvantage is that of warranty problems for the Government. While the component is sitting in a warehouse, its warranty, which the Government paid for, is expiring.

C. ANALYSIS OF THE QUESTIONNAIRE DATA

This section will analyze the responses to the survey questionnaires and focus on the most frequently mentioned problems associated with component nonavailability issues identified in Chapter IV. Each question will be stated as it appears on the questionnaire (Appendix C) at the beginning of each subsection.

1. Nonavailability Issues

This subsection will focus on the major problems expressed by the respondents. The first set of questions are listed below:

Question #1: What are the key items and/or components you manage or you are responsible for providing or replacing?

Question #2: If component obsolescence is a problem for the items you manage, please briefly explain the problems for each item or component.

The most common problem expressed by the respondents was the lack of sufficient or updated technical data packages for adequate competition. Technical data packages for low density, aging systems, typically have not been reviewed and updated on a regular basis, particularly prior to procurement actions. The researcher feels this review action would address significant equipment deficiencies, identify possible technical enhancements, and identify nonavailable components. Since it is a normal evolution for a piece of equipment to move through its life cycle to eventual obsolescence, a TDP review could provide foresight into possible nonavailability problems. Another concern is the timely distribution of TDP changes to the item managers and contracting officials. This untimeliness has caused the procurement of obsolete components, delay of delivery, or the termination of contracts for convenience while the changes were being updated and distributed to the concerned individuals. The researcher suggests that the management of TDP reviews, updates, and distribution should be more closely monitored by supervisors.

The next problem expressed by respondents was that the system was out of production and the original manufacturer provided little or no logistical support. This included the original equipment manufacturer (OEM) or other contractors who had no interest in producing the components due to the age of the technology. Most contractors want to concentrate their efforts on technology that has both a military and commercial application. When the commercial technology has become obsolete, the contractor has little incentive to continue to produce the items. In some cases the original manufacturer will sell off the tooling capabilities for the obsolete items to smaller firms to make room for new state-of-the-art capabilities. [Ref. 19] If the original equipment manufacturer did maintain the capabilities to produce the nonavailable components, the tooling set-up costs have sometimes made it cost prohibitive to produce the components for both the contractor and the Government. This is due to the sharing of set-up costs between the contractor and the Government. Only certain allowable costs are permitted for recoupment by the contractor, which means that the Government will pay for a large portion of the costs. This adds greatly to the costs of out-of-production spare parts.

Another significant problem causing component nonavailability has been the purging of the inventory of components by the depots due to low demand and the items sold as scrap. Taking the field bakery as an example, DLA deemed the bakery an obsolete item in the mid-1970s and purged the system of all consumable repair and spare parts for the system. [Ref. 20] DLA's current policy is to convert low demand components from stocked to non-stocked items. If the item manager labels a component as essential, then DLA will not convert the item to non-stocked. If there is no demand for a part for two years, DLA will notify the item manager as to possible disposal. The item manager then may present a case to DLA to maintain the part in storage. If the part has no demand for six years it is then sent for disposal and usually sold as scrap. [Ref. 28] The new policies help prevent what occurred in the mid-70s from happening again, but they appear to place the full burden of responsibility solely on the item manager to notify DLA.

Another problem cited by participants involved vendors and depots not being able to locate components due to multiple part numbers. At the depot, this is due to the use of several vendors for the same or similar spare parts. Each vendor will use his own part number for the item. The depots, unfortunately, do not have the manpower to cross-reference each and every part that it manages. A vendor has this problem when they have deleted an old part from their inventory and replaced it with a similar part with a different part number. Requests from the Government using the old part number are delayed while the contractor identifies the replacement part.

The final problem stated in Chapter IV was the lack of well-developed failure rates for components. Without accurate failure rates for each repair and spare part, the available supply of parts could be depleted much faster than expected. This also means the expected procurement administrative leadtime (PALT) will have to be reduced in order to meet the demand requirements caused by the insufficient failure rates.

The researcher proposes that the Commodity Command Standard System that is used to collect performance data at the inventory control points, could also be used to assist in identifying potential nonavailable component data.

2. Identifying Demand for Nonavailable Spares

The second set of questions are listed below:

Question #3: Please list and briefly explain the current methods for identifying the requirements for the items you manage.

Question #4: How could obsolete spare parts be identified prior to their need, and would this be feasible or cost effective?

The respondents indicated that the report most beneficial to item managers for identifying component requirements is the Requirements Determination and Execution System (RDES). The RDES identifies components by stock number and lists the computed leadtimes for acquisition. Some of the leadtimes identified on the report include the safety level requirement, also referred to as the repair leadtime, the administrative leadtime, and the procurement leadtime or procurement reorder point. The researcher fails to see how the RDES report will give an indication as to the identification of demand for nonavailable spare parts. The report does indicate past demand and therefore is used to dictate future procurements. It does not specifically address component nonavailability.

One significant problem with the RDES report is that it can cause cutbacks when parts are ordered in accordance with the parts levels stated on the report, while the most current demand has actually been reduced for a period of time. When this happens, regulations require the excess stock be disposed of, instead of maintaining it in storage and reducing procurements in the future. The cutbacks in the past have also been accomplished by terminating a contract for convenience for the spare parts.

Respondents' recommendations for identifying the requirements for nonavailable components prior to their actual demand included: (1) a regular review of the Inventory Management Processing Codes (IMPC), (2) a contractor requirement to notify the Government when they are going to stop production of components, and (3) the development of more precise failure rate schedules. An additional area not mentioned by participants may be analysts beginning a careful review or screening process by Government analysts of items that may soon become unavailable. By carefully reviewing the documents associated with components of aging systems, an item manager or engineer should be able to detect components that are reaching the end of their life cycle, due to such occurrences as obsolescence.

3. Alternatives for Resolving Nonavailability

The third set of questions are listed below:

Question #5: What alternatives/solutions have been used or considered in the past to resolve requirements for obsolete spare parts?

Question #6: If delays were one of the problems, how long were they?

Question #7: If component obsolescence is a significant problem for the items or components you manage, how frequently does it occur?

Question #8: Are the items involved with the component obsolescence problem critical spare parts?

The acquisition alternatives as presented in Chapter IV are listed below:

1. Sourcing Alternatives
   a. original equipment manufacturer
   b. Government locates or develops a new source
   c. in-house fabrication
2. Engineering Alternatives
   a. commercial or nondevelopmental item substitute
   b. redesign
   c. reverse engineering
3. Supply Alternatives
   a. provide the next higher order of assembly
   b. cannibalization
   c. stockpile with a life-of-type quantity buy

The researcher will not analyze each alternative listed above, since it is not the focus of this research. This research focused on the critical factors evaluated to arrive at a decision on one of these alternatives. More in-depth analysis of these acquisition alternatives is provided in Lieutenant Tracy's thesis. [Ref. 15]

The average delay for the acquisition of nonavailable components ranged from four months to more than two years, although, some delays stretched as far as five years. These types of delays are detrimental not only to the readiness of the equipment and individual units, but to the entire U.S. Army. These delays were the result of the problems listed in section one above. The researcher observes that most of these problems of delay are within the realm of each Commodity Command to correct or control. This is because some of the problems are related to administrative leadtimes and inadequate management practices.

The frequency of occurrence of demands for nonavailable spare parts was monthly and quarterly for almost every system reported. This frequency places an enormous burden on the item managers and contracting personnel to resolve this problem on a recurring basis. Unless the problem is addressed for these aging low density items, it will become worse as more systems begin to fall into this category in the coming years of reduced defense budgets. The researcher believes the frequency of occurrence is in part due to users consistently ordering obsolete components. When an order is received for an obsolete item, the depot rejects it and returns it to the user. The request is then forwarded through the item manager for manual resolution, which causes even longer delays. The researcher believes this is caused by infrequent updating of technical manuals. The frequency of occurrence is may also be caused due to the depots no longer stocking an item. This requires the depot to procure a component each time they receive a demand, thereby, causing procurement delays and increased nonavailability problems.

The components evaluated for the field bakery plant and the LACV-30 were critical components. Critical components in this study are defined as those whose failure or absence will prevent the successful completion of the system's mission. Not every participant reported having component nonavailability problems involving critical spare parts.

4. Correcting Nonavailability Problems

The fourth set of questions are listed below:

Question #9: What factors were considered to select the best alternative/solution?

Question #10: Please explain briefly, from your experience, the problems involving component obsolescence which are improving and which ones are not.

Question #11: Please list and explain any recommendations you have to rectify the problems of meeting the requirements for replacing obsolete components.

As mentioned in Chapter IV, the primary considerations indicated by respondents, in the evaluation of alternatives were available funds or cost, the required delivery schedule, and to a lesser degree, contractor past performance and availability. The researcher suggests that there are additional critical factors that should be considered prior to the selection of one of the acquisition alternatives. These additional factors include: stability of the design of the system being supported, quantities of the item required, complexity of the item, storage and shelf-life, proprietary data, and risk.

The available funds or cost criterion as interpreted for this study, involves not only the cost of the components, but the costs associated with implementation of the proposed solution. Costs for individual components appear to rise when they are non-stocked at the depots. The researcher believes these higher costs are due to contractor tooling set-up costs, new contractor qualification, qualification of commercial or NDI substitutes, or the costs of building in-house production capabilities.

The delivery schedule criterion involves the factor of having sufficient time to deal with the problem. It encompasses the time period from when a demand is received to when the item is finally delivered. This factor can seriously be affected when a contractor no longer wants to continue to produce an item. The researcher feels the first alternative is to try to convince the OEM to continue production of the needed component. This may require the contracting officer to investigate as to the motive behind the contractor's decision, and provide the proper incentive to keep him in production. When that fails, the Government is faced with having to locate an alterative source. If and when another source is located, it could require between 18-24 months to qualify him. These time lines can also apply to redesign or reverse engineering alternatives, as well as, commercial or NDI substitute qualifications. The delivery schedule can also determine how much redesign or reverse engineering effort can be done. It does not seem surprising with delays that item managers elect to chose cannibalization as their first alternative source.

Stability of design of the item is in reference to the system configuration remaining the same over a reasonable time. The system will be considered not stable if there are planned redesign efforts of components within the system or the system is currently be phased out of the inventory. The researcher observes that if the design of a particular component or system is stable, a contractor may feel more compelled to produce the components. This is due to the fact, that the contractor believes he will receive all future orders for the component, particularly if he knows he is a sole source.

The researcher believes that the quantities required to meet the demand on a continuous basis, will determine the affect this factor has on the optimum alternative. If there is sufficient demand for the item, then a contractor may be more inclined to produce an item. A sufficient demand may lead to an economic order quantity or a life-of-type quantity buy, which is a much more attractive offer to a contractor.

Component complexity involves the level of technology required to produce the component. The researcher believes that one of the causes of inadequate failure rate estimations may be due to the complexity of the items. This can lead to procuring too little or too much of a component and end up with component nonavailability problems or wasting funds due to the disposal of excess items. If an item is so complex, even owning the TDPs may not permit future competition, since only the original equipment manufacturer has the technology or know how to produce the item. This researcher proposes that complex items have possibly led to cannibalization or life-of-type quantity buys when the OEM refuses to produce the item any longer.

The shelf-life and storage factors need to be considered when considering to stockpile with a life-of-type quantity buy. This is due to the components being stored for extensive time periods. The researcher believes the length of time each component must be stored and in what condition it will be stored must be considered. A buyout will eliminate the Government's dependence on contractors to manage the elements of providing replenishment spares. Another consideration may be if there is a warranty involved, and if it is expiring while the component is sitting on a shelf in a warehouse.

Proprietary data will have to be considered when determining which alternative can be used, due to the limitations they place on the Government to compete the item. Without owning the data rights, the Government will only have the options of going back to the OEM, redesign, or reverse engineering. If the Government had procured at least Level II TDPs up front, then it has the capabilities of seeking other sources in out years.

Risk is a subjective assessment made regarding the likelihood of achieving a specific objective. [Ref. 3:p. 15-15] The researcher believes risk involves the contractor's past performance, financial stability, management practices, etc. If a contractor is severely deficient in any one of these areas, the chance of contract problems, and eventual delivery of the required item, is increased. The evaluation of each of these factors should guide the decision maker to the optimum acquisition alternative with the least disruption to the flow of supplies to the user.

Respondents provided a negative view of improvements rather than a positive view. Their responses consisted entirely of what needs improving versus what has improved. Although the respondents indicated nine important areas that should be addressed to help alleviate the component nonavailability problems, the researcher feels that their possible lack of management training may have limited their abilities to theorize possible solutions to the component nonavailability issues. From the researcher's perspective, one additional area needing improvement is the Army's automated information system to better identify possible commercial or nondevelopmental item substitutes. Another area would be the updating of the Army's automated contracting systems, which would shorten procurement leadtimes.

5. Service Life Extension and Technical Data Packages

The fifth set of questions are listed below:

Question #12: What are the current plans for service life extension for the items you manage?

Question #13: Are the original technical data packages available for your items and components?

Question #14: Please briefly explain, from your experience, what are the major causes to the supply problems of obsolete spare parts?

The Army has outlined its near-term modernization plans, which will be accomplished by upgrading the fielded equipment to insert modern technology. The combat service support branches are highlighted in two areas specifically as it may relate to this study: this includes the Army Field Feeding System (AFFS), which is to receive continuous improvements of operation rations, equipment, distribution systems, and soldier training; and the Army's Field Service Support System (FSSS), which encompasses the laundry, showers, clothing repair and exchange, mortuary affairs, and delousing sprayers. [Ref. 1:p. 70] Modernization of these two systems are essential to ensure a smaller force has the capacity to sustain itself and maintain an adequate quality of life in any contingency.

There are going to be even more demands on the already tight defense budget. The researcher believes that realistic goals and objectives will have to be set with regards to which systems receive these stated upgrades.

Although Level III technical data packages were available for the majority of the systems supported by the respondents of the survey questionnaire, the Government does not have data rights to the TDPs. Without ownership of the data rights, the Government will be unable to compete future requirements. This may also be one of the contributing factors as to why the technical data packages are infrequently updated.

The perceived problems with the supply system that are contributing to component nonavailability included five recurring factors as stated by the respondents. Almost every item manager agreed that the supply system is designed to meet the needs for high density items, not low density items. The realization of this fact, however has not corrected many of the deficiencies within the system. The stated problems from the survey appear to be applicable to both procurement and supply.

The first problem stated was the lack of available contractors. This problem is being addressed across the entire industrial base. Few people in Government today would disagree that manufacturing decline threatens our national security. As stated earlier, many companies are just flat refusing to accept any form of Government business, others who only did defense work are going out of business due to the decline of the DOD budget, and yet others are streamlining their products in order to better compete for what is left. The researcher believes that DOD should take a more active role in preventing the reduction of manufacturing sources and material shortages of the industrial base. Without some form of assistance from the Government, the industrial base will diminish as the market dictates. This reduction may not be in the best interest of the Army. The Governments' action should only be required when critical item manufacturing capabilities are endangered by the loss or impending loss of manufacturing sources, by nonavailability of other than single or sole sources, or by material shortages. [Ref. 29:p. 89] There seem to be many causes to the diminishing industrial base, but few remedies to fix it.

The second problem stated was the low level of visibility that low density systems receive from the Army. There is nothing that can be done about the density of an item, but the Army needs to identify the many low density items in the inventory and ensure they receive the necessary support to maintain their readiness. It is understandable that these low density items take a backseat to the major weapons programs, but this should not be at the expense of their maintainability and operational readiness. This researcher believes the attitude about low density, low visibility systems in the Army, may very well affect the sustainability and quality of life of soldiers deployed on any contingency, if these systems are neglected and not maintained or replaced.

The third problem stated was the infrequent updating of technical manuals. Since the using unit orders parts as listed in the technical manuals, it may order repair or spare parts that have had their stock numbers changed due to obsolescence, nonavailability, or configuration changes. In some cases the depot will delete items with the old stock numbers, so a requisition for that part will be returned to the user as a nonavailable item. The researcher has found that it usually takes between six to nine months to rectify the problem. The problem might be alleviated by the timely distribution of changes to the technical data packages. The timely distribution of TDP changes will permit timely updates of technical manuals which are then provided to the users.

The next problem stated was the lack of communication between item managers and depot personnel. This was apparent to the researcher by the lack of knowledge of most item managers as to the current policies and procedures of DLA managed depots. There is a need to train or at least familiarize Army Commodity Command and DLA acquisition personnel, including item managers, in each command's policies and procedures as it might relate to their jobs. This should open communication links between the various organizations. This is particularly important as DLA assumes a larger role in managing Army repair and spare parts.

The final problem was insufficient notice from contractors that they were stopping production of a particular component. This has prevented the Government from acquiring the forecasted requirement of components before production ceased. The Government's main concern would be to keep the contractor producing the required spare parts until another source could be located. There are many different methods to possibly accomplish this, but first the motive of the contractor must be determined. The researcher believes that the contracting officer is the vital link in resolving this problem. He should be maintaining a close professional relationship with the contractors, so as to be aware of contractor decisions that will affect the supply of goods to the military.

6. Other Acquisition Methods

The sixth set of questions asked of respondents are listed below.

Question #15: Are you aware of other methods of filling obsolete spare parts requisitions used by other agencies or Services?

Question #16: If so, please list and briefly explain each method.

Question #17: Have you ever utilized foreign sources to meet demands for obsolete components, and if not why?

Questions 18-22 were directed toward those respondents that had utilized foreign sourcing to resolve component obsolescence, however, there was no response to any of these questions.

Only one respondent acknowledged any awareness of such acquisition policies or procedures by other commands or Services. This appears to indicate a definite lack of communication among agencies. This may be a failure in either the command structure or individual initiative or a combination of both.

The questions on foreign competition were to determine the extent of the use of allies as possible sources for nonavailable components in the U.S. Due to the responses to the survey questionnaire, it appears, at least for combat service support equipment, that foreign sourcing is virtually nonexistent. Some U.S. allies are producing spare parts for U.S. equipment in their inventories due to the lack of support obtained from the U.S. As an example, Korean President Park took action in 1970 to develop the Korean defense industry due to the weak credibility of U.S. commitment and support. [Ref. 30:p. 19] Korean defense still depends on the U.S. for the majority of their military equipment, including spare parts. In a recent Naval Postgraduate School research paper, it was suggested that a vertical teaming approach be used to produce "non-conflict of interest items". These are items for which no known U.S. sources are interested in producing. [Ref. 30:p. 16]

The options to utilizing foreign sourcing have not been explored by the material management and contracting branches at ATCOM or presumably other Commodity Commands. As the U.S. defense industrial base declines even more in the future, it will be harder to utilize foreign sources as policy makers and the public will want to keep business here at home, even at the expense of readiness. On the other hand, there may be a greater need to utilize foreign sourcing, because U.S. contractors may not exist that can produce the needed components for aging systems.

D. SUMMARY

This chapter has presented the advantages and disadvantages of each of the nine alternatives examined in this study. The choice of an alternative to solve a component nonavailability issue will depend on individual circumstances. Also an analysis of the responses of each question from the survey are presented in this chapter. The questions were grouped into six topic areas as in Chapter IV. The questionnaire was utilized to get a consensus from the material management and contracting officials in an Army Commodity Command as to the problems surrounding the component nonavailability issue.

The next chapter will present the researcher's conclusions drawn from the study and recommendations for action by Army activities. The research questions for this thesis will also be answered in the next chapter.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

Operational readiness of military equipment depends on having the right spare parts and components available where and when they are needed. Timely acquisition of spare parts is a crucial aspect of Department of Army, as well as DOD, procurement. Decisions affecting spare parts must be made very early in the life cycle of the materiel system. Replenishment spare parts and repair parts must be obtained in the most cost-effective manner, due to the quickly declining defense budget. If we, the Army, do not fix the process ourselves, someone else will tell us how to fix it. That someone will probably be Congress and the military does not need additional oversight from Capital Hill.

The purpose of this thesis has been to provide contracting officers and item managers with an overview of issues and problems encountered supporting aging systems in the U.S. Army inventory and to provide possible alternatives and recommendations to deal with these problems. To accomplish this, the researcher reviewed current acquisition procedures, the theoretical and analytical framework, discussed possible alternatives, including their advantages and disadvantages, to resolve the problems, and gathered a compendium of responses from a Commodity Command via a survey questionnaire.

B. CONCLUSIONS

The following conclusions have been drawn as a result of this study.

Procedures for the identification and selection of possible alternative solutions to the component nonavailability issue are not formalized. Current procedures identify affected systems and notify decision makers as to the pending or current component nonavailability issue. However, there is no formalized policy or procedure to assist the decision makers as to the available alternatives to correct the situation. As depicted from the responses to the survey questionnaire, the only two factors routinely considered to correct the problem were time for delivery and cost. These factors consistently led the decision makers to chose the alternative of cannibalization, versus going through proper sourcing procedures to find a long term solution.

The current supply and contracting systems appear to be more in-line with supporting high density items. As pointed out in this thesis, when components are in low demand, depots will not routinely stock the items. Instead, they become a non-stocked item which must be reordered when a requirement is received from a user. Due to the lack of available sources in many cases, this procedure creates unacceptable delays in delivery of the required components or forces utilization of less than favorable supply alternatives, such as cannibalization. The burden of the work to prevent low demand components from being purged from the depots is on the item manager, although, in many cases he has no direct oversight of the components. This is the case regarding those parts now managed by DLA.

There is little crossfeed communication between U.S. Army Commodity Commands, DLA, and other Services' procurement activities. An effective communication flow of information between the Services' and DLA's procurement activities would assist in the identification of common problems and solutions to the component nonavailability issue. Each Service has implemented various programs to attempt to resolve their spare parts problems, such as, the SPRINT program for Army, BOSS and RAMP programs for the Navy, and the Air Force's AFMAG recommendations. A combination of various aspects of each program may provide benefits to DOD as a whole to resolve problems with the component nonavailability issues. DLA and the Army must share their experiences to facilitate consistency and a comprehensive acquisition system.

C. RECOMMENDATIONS

1. Consideration should be given to purchasing Level II or Level III technical data packages at the time of initial fielding of a system. One the largest impediments to

competition and the acquisition of nonavailable spares, according to responses from contracting officials and item managers, is the lack of sufficient, accurate, and legible technical data. Future acquisitions of major systems should include Level II or Level III technical data packages if fiscally possible. Level II TDPs are usually sufficient for contractors to produce the required item. [Ref. 31] Level III TDPs may only be essential for critical or complex components. This will enable the Army to compete follow-on logistics support.

One method the Army may consider to get contractors to compete for the production of aging components, if the Army owned the rights to the technical data packages, would be to provide the TDPs to possible competitors to generate more accurate and genuine bids or proposals. Another method may be to utilize performance specifications versus design specifications, which would allow the contractor the latitude to apply known, less expensive commercial technologies to the component. One last method may be to modify the requirement to accommodate producers who could compete if particular modifications were allowed. This again would allow the contractors the opportunity to substitute known technologies where possible to reduce costs. [Ref. 15:p. 36]

Another consideration concerning data rights may be that the Government may not have to honor proprietary data markings when it is no longer a trade secret or the original manufacturer is no longer in business. Also, the contracting officer should be challenging data rights and restrictive markings when he feels they are unjustified.

2. An analysis of alternatives to avoid nonavailability should be initiated prior to the time an original equipment manufacturer or current contractor intends to discontinue production of a component. This will require first that the contractor notify the Government of plans to stop production of a component with ample time to consider various alternatives. This analysis should involve an imaginative search for alternative sources, and faster and less costly qualification procedures, similar to DLA's liaison practices with original equipment manufactures. [Ref: 2:p. 28] The additional cost of using the OEM may be considered as temporarily acceptable, in an effort to explore less costly, more permanent solutions. A sufficient cost analysis should be performed on each available alternative to assist in the selection process. This area also involves training the personnel involved in the decision process, i.e., item managers and contracting personnel, concerning the full range of available alternatives and the procedures necessary to apply each successfully.

3. Institute an in-house market research team at each Commodity Command to formulate and maintain an updated automated information system capable of locating contractors to manufacture spare parts or provide suitable commercial or

NDI substitutes. A common problem indicated throughout this study was the lack of contractors willing to manufacture needed components. There needs to be a proactive, not reactive, attitude to identifying nonavailable components prior to the problem of nonavailability. We must be open-minded and not set on any particular solution or the status quo, if we are to successfully resolve these problems. The Army should attempt to use, to the maximum extent possible, commercial or NDI substitutes. A cost-benefit analysis should be performed to verify the applicability of this recommendation.

4. The Army should implement a more progressive automated contracting system. With new technologies today, the administrative leadtimes, paper workload, and delivery times involved in contracting for aging components, can be greatly reduced. DLA has made significant progress in automating their contracting operations in support of their mission of managing, procuring, and storing all common DOD consumable spare parts. These automated information systems that have been developed, or are being developed, have or will improve the efficiency of spare parts acquisition. Most of these systems work in conjunction with the Standard Automated Material Management System (SAMMS). Listed below are some of the automated systems DLA is currently using or developing for contracting applications [Ref. 32]:

- Advanced Agreements (AA) system

- Paperless Order Placement System (POPS)
- SAMMS Procurement by Electronic Data Exchange (SPEDE)
- Small Purchase Electronic Competitive System (SPECS)
- DLA Preaward Contracting System (DPACS)

The Army needs to accelerate their upgrading of computer systems that generate requirements and supports the acquisition process.

5. An evaluation of the Navy's Rapid Acquisition of Manufactured Parts (RAMP) program should be conducted for possible implementation at Army maintenance depots and by contractors. This may require the Army to acquire the necessary tooling for the depots with a large initial investment, but the benefits of parts on demand will allow the initial investment to pay for itself quickly. RAMP will ensure the availability of critical spare parts that are either out of stock or out of production, and ensure the highest quality achievable. The Navy has shown that most parts are delivered to the user within 30 days of ordering. [Ref. 17:p. 28] RAMP will prevent Army items from becoming obsolete due to nonavailable spare parts. Contractors should also look into applying RAMP principles to provide a parts on demand capability, not only for the military, but for their commercial business as well.

6. Evaluate aging, low density systems for mission requirements. If a definitive mission no longer exists for a particular piece of equipment, then it needs to be deleted

from the inventory immediately. According to Army policy, we will only modernize our most essential warfighting capabilities, thus upgrading systems where high payoff in operational capability or support and personnel savings are evident. [Ref. 1:p. 47] As an example, the Marine Corps has reportedly never utilized their field bakery plants in a contingency operation. [Ref. 11] The field bakery plant mission for the Army could possibly be redefined to include natural disaster preparedness and assistance, as in the recent case of Hurricane Andrew in Florida. This type of mission may provide aging Army equipment with a higher priority in the eyes of Congress, thereby, ensuring its survival.

D. ANSWER TO PRIMARY RESEARCH QUESTION

What are the critical factors decision makers must consider that will assist in the identification and selection of the optimum acquisition alternative?

The critical factors that were considered for the acquisition of nonavailable spare parts were identified in Chapter V. These factors are as follows: cost or availability of funds, required delivery schedule, contractor past performance, design stability, availability, risk, quantity, storage, shelf-life, proprietary data, and complexity of item. Each factor need to be addressed prior to the selection of an alternative to acquire nonavailable spare parts. Analysis of these factors will provide a valuable guide and an expanded perspective for approaching the problem of component nonavailability. Without analysis of the factors beforehand, serious delays in providing needed components to end users can occur. This will in turn reduce mission readiness and sustainability of equipment.

E. ANSWERS TO SUBSIDIARY RESEARCH QUESTIONS

1. What might be a typical scenario under which acquisition problems surface for components of aging equipment?

As described in Chapters IV and V, there are going to be various scenarios in which acquisition problems surface for components of aging systems. A typical scenario under which problems surface for components of aging equipment may be when a system remains in service for much longer than originally expected and technology surpasses the design. Problems emerge when the contractors no longer want to produce the older technology, especially for a low demand, low density system, in which little profit is usually involved. Another scenario might be when the depot classifies a system as obsolete and disposes of the spares for that system. The item manager must maintain good lines of communication with the depots to prevent this from happening. One other scenario may be the negligence of the engineers to develop an accurate failure rate. This can lead to the increased demand for the component, thereby, exhausting available supplies long before another planned procurement or an alternative solution is created.

2. What are the key reasons requirements for nonavailable components cannot readily be met?

The key reasons requirements for nonavailable components cannot readily be met have been addressed in Chapters IV and V. The problems causing component nonavailability included: lack of sufficient technical data packages, the original equipment manufacturer no longer produces the component and provides little or no logistical support for the system, improper source coding, policies and procedures of the depots for low demand spare parts, and multiple part numbers for the same or similar component.

3. What alternatives are currently available and utilized to resolve the problems associated with nonavailable components?

The alternatives that are most currently available and utilized, to varying degrees, to resolve the problems associated with component nonavailability are as follows:

1. Sourcing Alternatives
    a. original equipment manufacturer
    b. Government locates or develops a new source
    c. in-house fabrication
2. Engineering Alternatives
    a. commercial or nondevelopmental item substitutes
    b. redesign

c. reverse engineering

3. Supply Alternatives

a. provide next higher order of assembly

b. cannibalization

c. stockpile with a life-of-type quantity buy

Factors, advantages, and disadvantages relevant to these alternatives have been discussed and analyzed in Chapters IV and V. The selection of an alternative is one mainly dependent on individual judgment. The use of the advantages, disadvantages, and the analysis of the critical evaluation factors in this thesis may be of assistance when determining the best possible alternative to a component nonavailability issue.

F. ADDITIONAL AREAS OF RESEARCH

This study has identified and discussed the acquisition alternatives utilized by contracting officers and item managers located at ATCOM, to resolve the component nonavailability problems. All possible alternatives and factors related to their selection process have not necessarily been addressed and discussions have not been all inclusive. Due to this , suggested further research areas include:

1. A study as to the cost-benefit and implementation of an automated information system at each Commodity Command to

track potential commercial and NDI components as well as potential manufacturers.

2. Develop the most efficient method to implement an automated information system in Army contracting activities to utilize the latest technology.

3. Examine procedures used by other Commodity Commands, Services, and DLA to implement a standard DOD evaluation and selection procedure.

APPENDIX A

DEFINITIONS

Availability: A measure of the degree to which an item is in the operable and committable state at the start of a mission when the mission is called for at an unknown time. [Ref. 3:p. 15-2]

Component Obsolescence: an occurrence, for a particular item, in which the function served by that item is no longer required, because units are replaced as they are consumed by a substitute item which perform similar or identical functions, or because of a program of systematic replacement by a substitute item. [Ref. 33:p. 2] In logistics parlance, component obsolescence is known as a diminishing manufacturing source problem. [Ref. 34:p. 1]

Critical Component: an item whose failure or absence will prevent the successful completion of a system's mission.

Diminishing Manufacturing Source: a situation that occurs when the last known manufacturing source discontinues or intends to discontinue production of items required to logistically support a military system. [Ref. 35:p. 2]

Leap-Ahead Overmatching Technologies: those technologies that permit the deployment and production of significant technological advances over currently fielded designs in order to overmatch any potential adversary's capability. This is a change from past practices that have allowed development and deployment of incremental technological advances to fielded equipment.

Low Density Items: systems with fewer than 500 in the current active inventory; this includes active, reserves, and National Guard units.

Modularity: implies easy removal and replacement of components or subassemblies facilitating repair of faulty equipment. [Ref. 36:p. 42]

Repair Parts: consumables bits and pieces, that is, individual parts or nonreparable assemblies, required for the repair of spare parts or major end items. [Ref. 3:p. 15-15]

Service Life Extension Program: a program designed to reduce operation and support costs while extending the service life of current assets until they are replaced. [Ref. 1:p. 46]

Spare Parts: repairable components or assemblies used for maintenance replacement purposes in major end items of equipment. [Ref. 3:p. 15-16]

Sustainability: the degree to which a systems design characteristics and planned logistics resources meet system peacetime readiness and wartime utilization requirements. [Ref. 1:p. 67]

Technical Data Package: recorded information regardless of form or character of a scientific or technical nature, adequate for supporting an acquisition strategy, production, engineering, and logistics support. [Ref. 3:p. 15-17]

APPENDIX B

ABBREVIATIONS AND ACRONYMS

AFFS	Army Field Feeding System
AFMAG	Air Force Management Analysis Group
AMC	Army Materiel Command
APU	Auxiliary Power Unit
ARCSIP	Army Requirements System for Initial Provisioning
ASL	Authorized Stockage List
ATCOM	Aviation and Troop Command
BOA	Basic Ordering Agreement
BOSS	Buy Our Spares Smart
CAD	Computer-aided Design
CAM	Computer-aided Manufacturing
CCSS	Commodity Command Standard System
DESCOM	U.S. Army Depot System Command
DFARS	Defense Federal Acquisition Regulation Supplement
DLA	Defense Logistics Agency
DLSIE	Defense Logistics Studies Information Exchange
DRD	Demand Return Disposal file
DTIC	Defense Technical Information Center
ECP	Engineering Change Proposal
EOQ	Economic Order Quantity
FSSS	Field Service Support System
GOCO	Government Owned-Contractor Operated

GOGO	Government Owned-Government Operated
IMPC	Inventory Management Processing Code
LACV	Light Air Cushioned Vehicle
MIRV	Major Item Requisition Validation
NDI	Nondevelopmental Item
OEM	Original Equipment Manufacturer
OFPP	Office of Federal Procurement Policy
PALT	Procurement Administrative Lead Time
PLL	Prescribed Load List
PPBS	Planning, Programming and Budgeting System
PWD	Procurement Work Directive
RAMP	Rapid Acquisition of Manufactured Parts
RDES	Requirements Determination and Execution System
SAACONS	Standard Army Automated Contracting System
SAILS	Standard Intermediate Level Supply System
SDS	Standard Depot System
SPRINT	Spare Parts Review Initiatives
TAEDP	Total Army Equipment Distribution Plan
TDP	Technical Data Package

APPENDIX C

QUESTIONNAIRE

Instructions: Please complete the questions below to the best of your abilities. If you are unable to answer a question due to your position, please state "does not apply." Use additional paper if necessary to complete answers with as much detail as possible. (I realize that I have limited experience in this arena, so if there are additional problems and/or recommended solutions that you can think of not addressed in the questionnaire, please do not hesitate to include them.)

Purpose: The primary intent of this research is to provide contracting officers and item managers with an overview of the component obsolescence problem, and to develop a streamlined and formalized procedure for selecting the most favorable and feasible alternative.

Name: ______________________
Title: ______________________
Phone: (DSN) ________________
Phone: (Fax) ________________
Phone: (Com) ________________
Address: ____________________
____
____

1. What are the key items and/or components you manage or you are responsible for providing or replacing?

a. ________________
b. ________________
c. ________________

2. If component obsolescence is a problem for the items you manage, please briefly explain the problems for each item or component.

a.

b.

c.

3. Please list and briefly explain the current methods for identifying the requirements for the items you manage.

a.

b.

c.

4. How could obsolete spare parts be identified prior to their need, and would this be feasible or cost effective?

5. What alternatives/solutions have been used or considered in the past to resolve requirements for obsolete spare parts?

a. ____________________
b. ____________________
c. ____________________
d. ____________________
e. ____________________

6. If delays were one of the problems, how long were they?

< 1 week	_____	7 - 12 months	_____
1 - 4 weeks	_____	1 - 2 years	_____
1 - 3 months	_____	3 - 5 years	_____
4 - 6 months	_____	5+ years	_____

7. If component obsolescence is a significant problem for the items or components you manage, how frequently does it occur?

	Yes	No	Monthly	Quarterly	Annually	Other
Item a:	_____	_____	_____	_____	_____	_____
Item b:	_____	_____	_____	_____	_____	_____
Item c:	_____	_____	_____	_____	_____	_____

8. Are the items involved with the component obsolescence problem critical spare parts? Yes _____ No _____

9. What evaluation factors were considered to select the best alternative/solution?

10. Please explain briefly, from your experience, the problems involving component obsolescence which are improving and which ones are not.

11. Please list and explain any recommendations you have to rectify the problems of meeting the requirements for replacing obsolete components.

12. What are the current plans for service life extension for the items you manage?

13. Are the original technical data packages available for your items and components? Yes _____ No _____

14. Please briefly explain, from your experience, what are the major causes to the supply problems of obsolete spare parts?

a.

b.

c.

15. Are you aware of other methods of filling obsolete spare parts requisitions used by other agencies/services?

Yes _____ No _____

16. If so, please list and briefly explain these methods.

a.

b.

17. Have you ever utilized foreign sources to meet demands for obsolete components, and if not, why?

Please answer questions 18-22 if components have ever been acquired from foreign sources to fill your requirements.

18. When releasing a solicitation for an obsolete component, were foreign sources permitted to compete for the contract? Yes _____ No _____

19. Are there known foreign sources for these obsolete components? Yes _____ No _____.

20. If there are known foreign sources for these obsolete components, to what extent have they been solicited?

never _____ frequently _____
sometimes _____ always _____

21. Please list and explain what major problems have been encountered with foreign suppliers of these obsolete components.

23. If Federal statutes have been a limiting factor of fully using foreign suppliers for spare part requirements, please list which statutes apply and why.

a.

b.

Please provide any other additional information as you may feel pertinent to this research project or any other questions you feel are important to the issue that were not asked. When you have completed the questionnaire, please seal it in the envelope provided and return it to the designated point of contact in your organization.

Again thank you for your time and assistance in this research, it is very much appreciated.

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